

Macro Economic Variable in Indonesia with Cointegration Model

QODARIAH, SE, MM
Lecturer
Budi Luhur University
Jakarta, Indonesia

Abstract:

This study aims to look at how the use of time series model of cointegration tests on macroeconomic variables in Indonesia, using the consumer price index and inflation. The use of the time scale between long-term and short-term modeling of time series data has attracted much attention of researchers in the last two decades. Long-term characteristics in the form of economic and financial data are usually associated with testing data is non-stationary time series is commonly called a trend, whereas short-term fluctuations are stationary time series which is called the cycle. In the process of time that occurs in the event of an economic and financial time series data can be viewed as a combination of components of a data in the form of trends and cycles.

Usually, a shock to a time series is stationary will have the effect will gradually disappear, it will leave permanent effects on the time series in the future that affects a little time away, while a shock to a time series of non-stationary will permanently change the way the time series, or will permanently move the activity to a different level, either the lower level or to a higher level.

Key words: inflation, the consumer price index, causality, stationarity, cointegration.

INTRODUCTION

The consumer price index (English: the consumer price index) is

an index number that measures the average price of goods and services consumed by households (household). CPI is often used to measure the inflation rate of a country as well as consideration for the adjustment of salaries, wages, pensions, and other contracts. To estimate the value of the CPI in the future, economists use the producer price index, which is the average price of raw materials needed to make the product manufacturer. To measure the price at the macro level, usually using measurements Consumer Price Index (CPI) or the Consumer Price Index (CPI). Consumer Price Index (CPI) can be interpreted as a price index of the cost of a set of consumer goods respectively were weighted according to the proportion of public expenditure for the commodity in question. CPI measures the price of a set of specific goods (example staple food, clothing, housing, and miscellaneous goods and services) are bought by consumers.

Consumer price index (CPI) is the percentage that is used to analyze the level / rate of inflation. CPI is also an indicator that is used by the government to measure inflation in Indonesia. In Indonesia, the body tasked to calculate the Consumer Price Index (CPI) is the Central Statistics Agency (BPS). The calculation of the CPI begins with collecting the prices of thousands of goods and services. If GDP change the number of various goods and services into a single number that measures the value of production, CPI change the range of prices of goods and services into a single index measuring sseluruh price level.

So CPI / CPI change the prices of many goods and services into a single Indes measuring the overall level of prices. CPI is then obtained based on the amount of the rate of inflation / deflation, ie the percentage change in CPI between periods. Figures inflation / deflation reflects the purchasing power of the money spent to meet their daily needs. The higher the inflation, the lower the purchasing power of money and consequently the lower the purchasing power of goods and services the needs of the household. The inflation rate is not too

high would make the stability is maintained and the economy can keep on rolling.

BASIS THEORY AND DEVELOPMENT HYPOTHESIS

Inflation Theory and The projections

Inflation according to A.P. Lehnerinflasi is a situation where there is excess demand (Excess Demand) against the goods in the overall economy. Ackley other experts that provide understanding of inflation as a continuous rise in prices of goods and services in general (not the kind of goods only and for a moment).

Meanwhile, according to Boediono, inflation as the tendency of prices to rise in general and continuously. The increase in the price of one or two items alone can not be called inflation, unless the increase is extended to or result in increases in most of the other goods.

Inflation can be interpreted as a process of rising prices in general and continuously or inflation is also a process of decline in currency values continuously. Inflation is the process of an event, not the high-low price levels. That is, the price level is considered high is not necessarily indicating inflation. Inflation is considered to occur if the price increase takes place continuously and interplay.

The term inflation is also used to mean an increase in money supply which is sometimes seen as the cause of rising prices. Although the economic analysis and economic policy on inflation since the 1970s can be divided into two sects, the Keynesians and Monetarists but in some literature mentioned a different version, where the flow is divided into inflation, Classical,

Keynesian, Monetarism, and Expectations.

1. The Classical Theory of Inflation

The theory holds that the price level is mainly determined by the amount of money in circulation, which can be explained by

the relationship between the value of money by the amount of money, as well as value for money and price. When the amount of money increases faster than the increase of goods the value of money will degenerate and is equal to the price increase. So according to the Classical, inflation means too much money or too much credit compared with the volume of transactions, the remedy is to limit the amount of money supply and credit.

Classical opinion that further can be formulated as follows:

$$\text{Inflation} = f(\text{money supply, credit})$$

2. Inflation Theory Keynes

This theory assumes that the economy already at full employment level. According to Keynes quantity of money does not affect the level of total demand, as an economy can have inflation even though the level of the quantity of money remains constant. If the money supply increases, prices will go up. This price increase will lead to increased demand for money for transactions, thereby raising interest rates. This will prevent the growing demand for investment and will soften inflationary pressures.

Analysis regarding inflation request Keynes formulated based on the concept inflationary gap. According to Keynes, inflation requests that really matters is generated by government expenditure, especially relating to the war, a program that massive investment in social capital.

Thus Keynes thought about inflation can be formulated into:

$$\text{Inflation} = f(\text{money supply, government spending, interest rates, investment})$$

3. Inflation Theory Monetarism

This theory argues that inflation is caused by monetary and fiscal policies are expansionary, so the amount of money circulating in the community greatly exaggerated. Excess

money supply in the community will lead to excess demand for goods and services in the real sector. According to the group monetarists, inflation can be reduced by restraining and eliminating the excess demand through monetary and fiscal policy is contractionary, or through control over wage increases and the abolition of the subsidy on foreign exchange rates. So that the inflation theory by Monetarism can be denoted as follows:

Inflation = f (an expansionary monetary policy, expansionary
fiscal policy)

4. Theory of Expectations

According to Dornbusch, that economic agents form expectations of inflation based on adaptive expectations and rational expectations. Rational expectations is the optimal prediction of the future by using all the available information. Rational understanding is a logical action to achieve goals based on existing information. That is simply theoretical expectations can be denoted to be:

Inflation = f (adaptive expectations, rational expectations)

TYPES OF INFLATION

1. According to the Initial Cause Inflation

a. Demand-Pull Inflation

Inflation that is caused due to the public demand for various goods too strong (often referred to as a pure inflation).

b. Cost-Push Inflation

Cost push inflation is characterized by rising prices and falling production. So inflation coupled with recession. This situation arises starts with a decrease in the supply of total (aggregate supply) as a result of the increase in production costs. The

increase in production will raise prices and declining production.

c. Inflation Demand and Supply

This inflation is due to the increase in demand on the one hand and on the other hand offers. The emergence of inflation as the perpetrator of supply and demand is not balanced meaning that if demand for goods increases while the supply of goods shortage.

2. Based on Origin Inflation

a. Domestic Inflation or inflation of domestic origin.

This inflation occurs because of the influence of economic events occurring in the country, for example the budget deficit which is continuously above by printing money. This causes the amount of money needed in the community exceeds the transaction and this causes the value of money is low and the price of goods increases.

b. Imported Inflation or inflation contracted from abroad.

Inflation is caused by rising prices of export goods such as tea and coffee abroad (export destination), the price has increased and this had an impact on prices in the country.

3. According Severity or Inflation, include:

- a. Inflation mild (<10%)
- b. Medium (10% - 30%)
- c. Weight (30% - 100%)
- d. Hyperinflation (> 100%)

MEASUREMENT OF INFLATION

Inflation is measured by calculating the percentage change in the rate of change of a price index. The price index includes:

1. Consumer Price Index (CPI) or the Consumer Price Index (CPI), is an index that measures

the average price of certain goods purchased by consumers.

2. Living Cost Index or Cost-Of-Living Index (COLI).

3. The Producer Price Index is an index that measures the average price of goods required manufacturers to perform the production process. IHP is often used to predict the level of CPI in the future due to changes in raw material prices increased production costs, which in turn will increase the price of consumer goods.

4. Commodity Price Index is an index that measures the prices of certain commodities.

5. The GDP deflator shows the change in prices of all new, locally produced goods, finished goods, and services.

From the above mentioned index is often used to calculate the rate of inflation is the Consumer Price Index. The formula for determining the consumer price index.

h = The current price

h_{t-1} = price in the base year

Example:

The price of a type of goods in 2002 amounted to Rp. 6000, - and on the basis of the price of the goods Rp. 4,000, -, the price index in 2002 is as follows:

It means that in 2002 there has been a rise in price by 50%.

After calculating the consumer price index from period to other periods, we will compare the consumer price index and the results called Inflation. The inflation rate can be searched by the formula:

LI = Inflation

IH = price index this period

IH $t-1$ = price index last period

RESEARCH HYPOTHESIS

Root Test Test

From equation created or written by: $\Delta Y_t = \delta Y_{t-1} + u_t$

Then we can write the following hypothesis: $H_0: \delta = 0$ $H_1: \delta \neq 0$

If we do not reject the hypothesis $\delta = 0$ then $P = 1$ means that we have a unit root, where the data time series Y_t is not stationary.

Test Kointegration

There are several models and methods for doing this cointegration test, one that is used by the author is using Johansen test. This test uses a technique hypothesis by comparing the trace statistik used with commonly used alpha value of 5% or 1%. Reject or accept the cointegration data tracanya if the figure is smaller than the critical value.

Causality Test

As we already know that there are two forms of hypotheses which we will do in this study:

- (1) Ho: Consumer Price Index and Inflation does not affect
H1: Affect the Consumer Price Index (cause) Inflation
- (2) Ho: The Consumer Price Index affects (not causing inflation
H1: Consumer Price Index Inflation affects cause

RESEARCH METHODS

Research Data

The data used in this study using data for March, June, Sept and December each year from 1982 to 2012. The data were collected from various web sites related government agencies, such as the Central Bureau of Statistics Web site, Web site of Bank Indonesia and other. The data obtained by the authors after the first processed and adjusted.

Time Research

The study was conducted during the months of November 2013 to February 2014. In November and December 2013 conducted by the authors for the collection of data research and collection of writings and make projections for the research method. January and February 2014 conducted by the authors for the

processing of the results of the research data have been obtained.

Data Analysis Techniques

Root Test Test

From equation created or written by:

$$\Delta Y_t = \delta Y_{t-1} + u_t$$

Where the value of Y is a unit root or not stationary. If $p = 1$ then the model becomes a random walk without a trend. Here we will face a problem where the variant Y_t is not stationary. This equation is obtained by reducing the side Y_{t-1} on the right and left, it will get the equation above.

$$Y_t - Y_{t-1} = p Y_{t-1} - Y_{t-1} + u_t$$

$$\Delta Y_t = (p-1) Y_{t-1} + u_t$$

Cointegration test

By looking at the form of the above equation then we will see a model of the relationship between the consumer price index and inflation in the form of the following equation:

$$IHK_t = \beta_0 + \beta_1 \text{Inflation} + u_t$$

Or write the equation of the form

$$u_t = IHK_t - \beta_0 - \beta_1 \text{Inflation}$$

If u_t is stationary then IHKs and inflation is said to be cointegrated or otherwise affect each other. Parameters are written can we call the cointegration parameter or can be called cointegration regression.

Causality Test

The equation used by the author is using lags equation 2, thereby obtained the following results:

$$Y_t = \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \epsilon_t$$

RESULTS AND DISCUSSION

There are three models of test used and it is often used in an economic analysis, particularly those involving the discussion of time series data. The third model of the test if we can combine into an economic analysis that will help researchers in analyzing the data held. The following three models tested in intent:

Root Test

For the first test normally used on stationeritas test data is commonly used test is the test model root test or commonly called augmented Dickey and fuller test. There are three options in this test model test, the first choice by entering the intercept, the second choice with the model intercept and trend and the last option to none. The author uses the final model for the analysis of this data. In the economic analysis of time series data is widely used, but behind it all turns out a lot of the time series data storing various problems, one of which autocorrelation and the second problem is. Actually a lot of in the model econometric model that can be used for time series data or requires us to have data which is stationary. It's one of the many test that can be used in the analysis of time series data was mainly a matter stationeritas data. Here we see a picture of the test results with test models of data stationeritas root test.

Table 1 : Result root test

Null Hypothesis: RESID01 has a unit root

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.322057	0.1667
Test critical values: 1% level	-3.484198	
5% level	-2.885051	
10% level	-2.579386	

*MacKinnon (1996) one-sided p-values.

Source : Proceed by author

Seen in the picture results generated probabilistic value of output for statistical absolute value is less than the critical value in the table Mac Kinnon at different levels of confidence. From the information showed that the CPI and inflation are not stationary or in other words, the data contains a unit root.

Cointegration test

If we look at 3 possible cointegration equation that occurs when we use the Johansen Kointegration Test. Johansen cointegration test of this is based on the model VAR (p) of a set of variables that are not stationary. In a test model of the Johansen cointegration analysis of variables is not simply just look at the results of the VAR equation system, usually used is the analysis of impulse response function and variance decomposition. We can see for the test model with Johansen test for cointegration display picture is as follows:

Table 2 : Result Cointegration test

Trend assumption: Linear deterministic trend

Series: IHK INF__IND_

Lags interval (in first differences): 1 to 2

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.228932	36.44576	15.49471	0.0000
At most 1 *	0.040388	4.988353	3.841466	0.0255

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source : Proceed by author

Visible if the value of the resulting trace statistic for the model used probabilistic significant at alpha level of 5%. And also we

can see in the picture if the value of the trace statistics are greater than the value of alpha is used, so that it can be concluded that both mutually cointegrated variables. In the economic analysis variables cointegrated if there is said to be in a state of equilibrium or long-term or so-called long-run equilibrium. So the model we used above would not be misleading, especially for long-term analysis, while for short-term need to be taken into account for short-term spike.

Test Causalities

This causality test is usually done when we will go or will test and measure simultaneously. But here the authors use this test to see how the relationship between the variables of data the consumer price index and the inflation rate in Indonesia. So later on these test results obtained by the influence of past data to current conditions. The following images for causality test results.

Table 3 : Result Granger causality test

Pairwise Granger Causality Tests

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
INF__IND_ does not Granger Cause IHK	122	0.38621	0.68049
IHK does not Granger Cause INF__IND_		0.05230	0.94907

Source : Proceed by author

It can be concluded from the above image output that the resulting probability level was greater than that used alpha level of 5%, so that in this study it can be concluded that variable consumer price index and the inflation rate in Indonesia did not influence each other.

CONCLUSION

Due to the model used variable consumer price index and the inflation rate no granger cause (no significant variable) then in general we can conclude that there is a variable granger causality of the consumer price index and the inflation rate. There are other ways that can be used to see the direction granger cause this than by using test causality granger that the ADL models. However, there is a requirement of a model will be carried out this test, if the two variable consumer price index and the inflation rate is stationary, as we already know that in the test conducted before the data, the variable data consumer price index and inflation is not stationary.

So that from this research can be concluded that the data variable consumer price index and inflation-containing unit root, and cointegrated but do not have a relationship between each other. Then the concept for further analysis with a model of long-term balance and correction of errors and forecasting models we can do, but to the concept of short-term on the variable data consumer price index and the inflation rate can not be used as an analysis of balance in the short term, because the consumer price index data and the inflation rate does not have a relationship, but we are also conducting step transformation or Differensi one.

REFERENCE

- Bender, K.A. and Theodossiou, I. (1999) International comparisons of the real wage–employment relationship, *Journal of Post-Keynesian Economics*, 21, 621–637.
- Beveridge, S. and Nelson, C.R. (1981). A new approach to decomposition of economic time series into permanent and transitory components with particular attention to measurement of the ‘business cycles’, *Journal of Monetary Economics*, 7, 151–174.

- Bambang, J. (2012), *Ekonometrika Deret Waktu Teori dan Aplikasi*, Cetakan pertama Penerbit IPB Press.
- Carstensen, K. and Hansen, G. (2000), Cointegration and common trends on the West German labour market, *Empirical Economics*, 25, 475–493.
- Dickey, D.A. and Fuller, W.A. (1979), Distribution of the estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association*, 74, 427–431.
- Dickey, D.A. and Fuller, W.A. (1981), The likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, 49, 1057–1072.
- Dwyer, G.P. Jr. and Wallace, M.S. (1992), Cointegration and market efficiency, *Journal of International Money and Finance*, 11, 318–327.
- Engle, R.F. and Granger, C.W.J. (1987), Co-integration and error correction: Representation, estimation, and testing, *Econometrica*, 55, 251–267.
- Engle, R.F. and Issler, J.V. (1995), Estimating common sectoral cycles, *Journal of Monetary Economics*, 35, 83–113.
- Engle, R.F. and Kozicki, S. (1993), Testing for common features, *Journal of Business and Economic Statistics*, 11, 369–395.
- Im, K.S., Pesaran, M.H. and Shin, Y. (1995), Testing for unit roots in heterogeneous panels, University of Cambridge, Department of Applied Economics Working Paper, Amalgamated Series:95-26.
- Johansen, S. (1988), Statistical analysis of cointegration vectors, *Journal of Economic Dynamics and Control*, 12, 231–254.
- Johansen, S. (1991), Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models, *Econometrica*, 59, 1551–1580.
- Johansen, S. and Juselius, K. (1990), Maximum likelihood estimation and inference on cointegration—with applications to the demand for money, *Oxford Bulletin of Economics and Statistics*, 52, 169–210.

- Kao, C. and Chiang, M. H. (1998), On the estimation and inference of a cointegrated regression in panel data, Centre for Policy Research Working Paper, Syracuse University.
- Kim, M., Szakmary, A.C. and Mathur, I. (2000), Price transmission dynamics between ADRs and their underlying foreign securities, *Journal of Banking and Finance*, 24, 1359–1382.
- Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. (1992), Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root? *Journal of Econometrics*, 54, 159–178.
- Levin, A. and Lin, C.F. (1992), Unit root tests in panel data: Asymptotic and finite sample properties, University of California, San Diego Department of Economics Working Paper: 92-23.
- Levin, A. and Lin, C.F. (1993), Unit root tests in panel data: New results, University of California, San Diego Department of Economics Working Paper: 93-56.
- Maddala, G.S. and Wu, S. (1999), A comparative study of unit root tests with panel data and a new simple test, *Oxford Bulletin of Economics and Statistics*, 61(0)(Specialissue), 631–652.
- Nacrowi, D.N, (2006), “Pendekatan Populer dan Praktis Ekonometerika Untuk Analisis Ekonomi dan Keuangan”. Penerbit Fakultas Ekonomi Universitas Indonesia.
- Pedroni, P. (1999), Critical values for cointegration tests in heterogeneous panels with multiple regressors, *Oxford Bulletin of Economics and Statistics*, 61(0)(Special issue), 653–670.
- Pesaran, M.H., Shin, Y. and Smith, R.J. (2000), Structural analysis of vector error correction models with exogenous I (1) variables, *Journal of Econometrics*, 97, 293–343.

Phillips, P.C.B. and Perron, P. (1988), Testing for a unit root in time series regression, *Biometrika*, 75, 335–346.

Stock, J.H. and Watson, M.W. (1988), Testing for common trends, *Journal of the American Statistical Association*, 83, 1097–1107.

Wing, W.W. (2007), “Analisis Ekonometrika dan Statistika Dengan EVIEWS”, Penerbit sekolah Tinggi Ilmu dan Manajemen YKPN, Yogyakarta.

https://id.wikipedia.org/wiki/Indeks_harga_konsumen

<https://sukasayurasem.wordpress.com/2008/09/15/teori-inflasi-dan-proyeksinya/>